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Original article

Comparative analysis of the structure of temporomandibular joint in human and rabbit

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Summary. In order to increase knowledge on the morphology and structure of the articular disc of the TMJ for a better understanding of the functional role of the same, it proceeded with an investigation on histological samples in the block of 'TMJ and periarticular tissues of adult rabbits and human fetuses at different stage of development. (www.actabiomedica.it)

Key words: temporomandibular joint, disk, structure

Introduction

In humans, the temporomandibular joint is an ellipsoid variety of the right and left synovial joints forming a bicondylar articulation. The temporomandibular joint can be defined a double and composed joint: double because it is formed by two distinct anatomical entities but closely related, connected with homologous and/or complementary dynamics; composite as it is constituted by two synovial rooms separated by the interposition of a fibrous lamina indicated as articular disc, which divides, exactly, the joint into two sections, each with its own synovial membrane (8).

The articular disc is a fibrous, avascular extension of the capsule that runs between the two articular surfaces of the temporomandibular joint. The disc articulates with the mandibular fossa of the temporal bone above and the condyle of the mandible below. The disc is also attached to the condyle medially and laterally by the collateral ligaments. The anterior disc attaches to the joint capsule and the superior head of the lateral pterygoid. The posterior portion attaches to the mandibular fossa and is referred to as the retrodiscal tissue.

It has an oval shape, biconcave in sagittal section; it's thin in central part and thick at posterios borders. It is shaped like a peaked cap that divides the joint into a larger upper compartment and a smaller lower compartment.The posterior margin is strongly convex in anteroposterior and much less convex in the lateromedial direction, it also distinctly higher than the anterior border and in the context articular takes relationship with the top of the mandibular fossa (9); lower, this end it has a shape perfectly complementary to the surface of the condyle. The anterior margin has a wide-ranging concavity in anteroposterior and a slight convexity in the lateromedial direction; it is perfectly complementary to the surface of the articular eminence and goes before, for a short distance, until the preglenoid plan. The central portion which in the joint position of centric relation corresponds to the area of contact between the front side of the disc and the articular eminence, is more subtle. The posterior bor-

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der is anchored at the top of the articular fossa along the petrotympanic fissure, through a thin fibroelastic lamina which delimit the posterior cavity of superior articular, inferiorly presents a more robust insertion on the posterior surface of the condyle; posteriorly it is related to the retrodiscal loose connective tissue which is the "retrodiscal pad" a structure rich of large venous sinuses that empty and fill alternately in relation to the disc excursion working as a hydraulic cushion suitable to compensate for variations in local pressure related the same disc excursion. Laterally and medially it adheres loosely to the capsule and is instead firmly fixed to the poles of the condyle; this connection ensures the simultaneity of the translation movements of the condyle and the disc and on the other hand does not hinder the movements simple rotation of the condyle. The anterior margin is tightly adherent to the capsule and through this has a close connection with the fibers of the superior head of the lateral pterygoid muscle (3). In rabbit TMJ the condyle is smaller and thin (6), with short neck of the condyle, there is no glenoid fossa but a slit of 3mm between the junction of zygomatic root of temporal bone and temporal bone, the condyle articulate with the slit in the base of skull with the zygomatic root of temporal bone, the shape of the condyle rather thin, the superior surface of rabbit condyle, anteriorly thicker and about 4 mm± and posteriorly 2 mm±, the length of the condyle about 10 mm± and neck length about 7 mm±, the anterior part of the condyle articulate with the zygomatic root of temporal bone with no glenoid fossa, the joint was covered by thin capsule, interiorly on the condyle there is a small depression may represent as condyle fossa for attachment of lateral pterygoid muscle. The articulation of the joint limits the function by hinge movement (opening closing) and protrusive retrusive movements. The aforementioned morphology was confirmed by radiologic studies (1,2,4,5) and some radiographic disease have been highlighted (7,10).

Materials and methods

This study was performed in 20 TMJ of human fetuses and 25 TMJ of young rabbits. The fetuses were aged between 10 and 32 weeks of gestation. Some of the fetuses were already fixed in formalin. All samples were removed with a block of tissue around the joint, they were fixed in Bouin's fluid, after the samples were fixed in paraffin and then were made sagittal and frontal serial sections at 8 microns using Zeiss Microtome Micron. These sections were treated with the following colors: hematoxylin and eosin, orcein, Weigert, Mallory-Azan. The camera used for images acquisition was a Zeiss axis microscope at various enlargements.

Results and discussion

The examination of the findings showed that in adult rabbit the disc is presented composed of a biconcave lamina less extended than the surface of the condyle (Fig. 1-2), fibrocartilaginous in nature (Fig. 3-4) with the elastic component present in peripheral seat (Fig. 4-5) and above all in correspondence of the attack to the rear face of the condyle differently from what observed in humans.In human fetuses at the stadium of 12 weeks the disc is already quite dif-

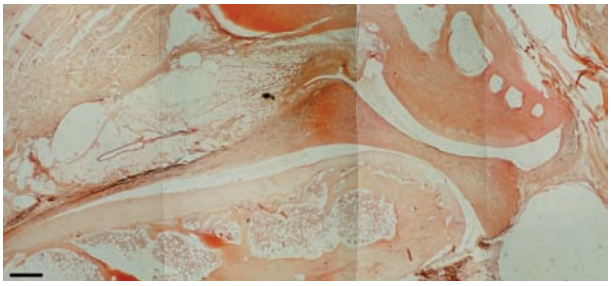

Figure 1. Rabbit. Sagittal section. Orcein. Bar = 500 μm

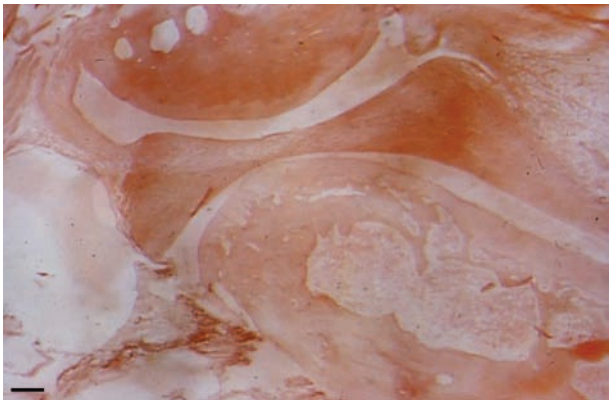

Figure 2. Rabbit. Sagittal section. Orcein. Bar = 500 μm

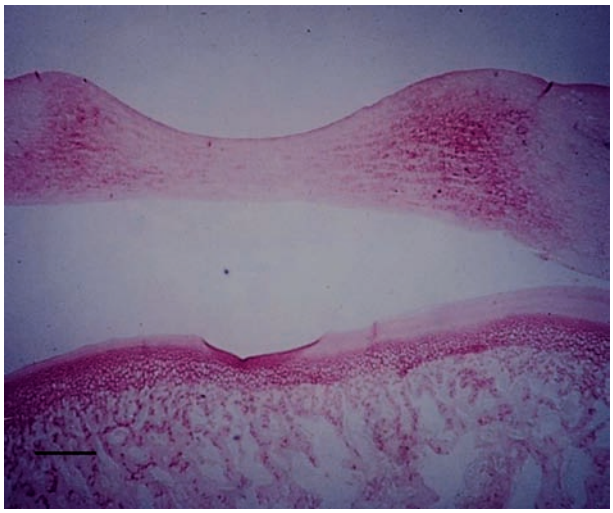

Figure 3. Rabbit. Sagittal section. Orcein. Bar =500 μm

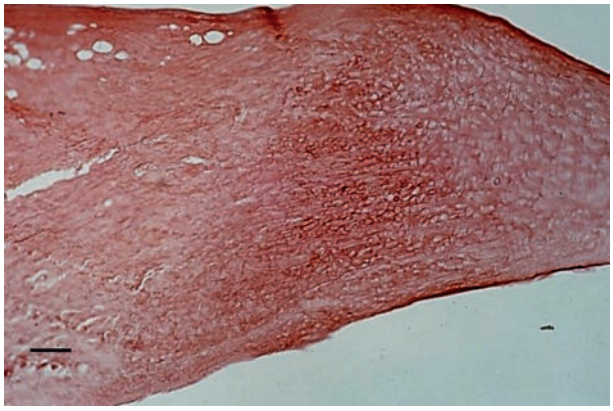

Figure 4. Rabbit. Particular of the articular disc's border. Orceina Bar = 200 μm

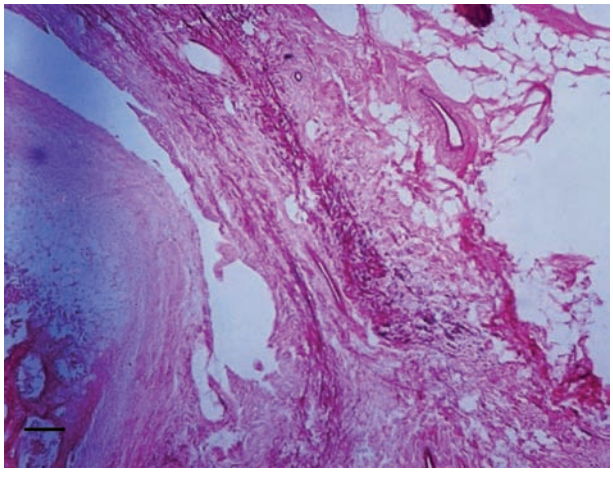

Figure 5. Rabbit. Retrodiscal pud. Orceina. Bar = 200 μm

ferentiated (Fig. 6): it comes in the form of biconcave lamina to greater development with longitudinal front end connected to the muscle groups pertaining to the sketches of the superior head of the lateral pterygoid muscle, the temporal muscle, the masseter muscle deep and the posterior border is presented in two unraveled fiber bundles respectively directed one towards the rear contour of the mandibular fossa, the other towards the rear face of the condyle, and include between them the cell-adipose tissue (Fig. 7).In the context of the direct beam rear boundary of the mandibular fossa they appreciate elastic fibers.In more advanced stages of development, 32 weeks, the disc will be appreciated in its paginate basically fibrous (Fig. 8) with clear elastic component (Fig. 9), consists of fibers more abundant at the periphery and arranged to form a three-dimensional system of connection of collagen component

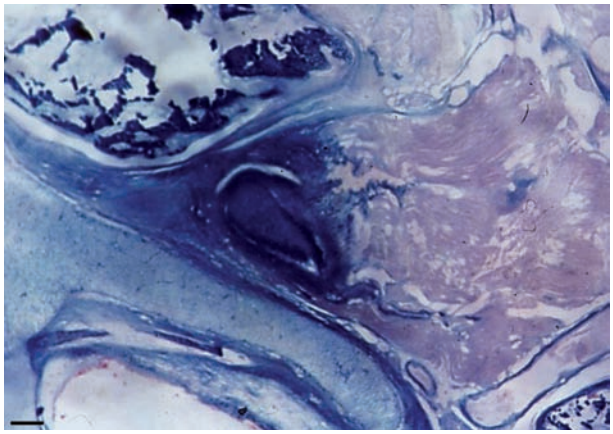

Figure 6. Human fetus - 12 weeks of gestation. Mallory Azan Bar = 500 μm

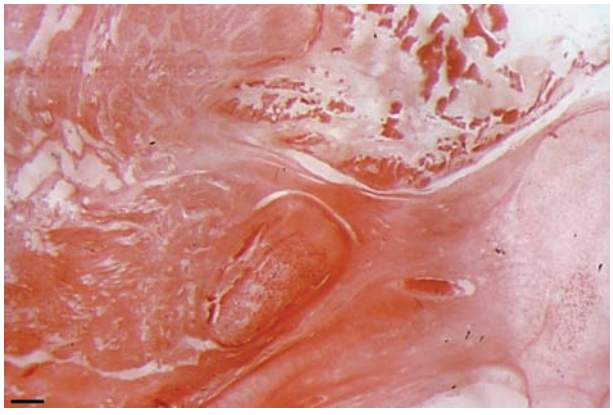

Figure 7. Human fetus - 12 week of gestation. Orcein. Bar = 500 μm

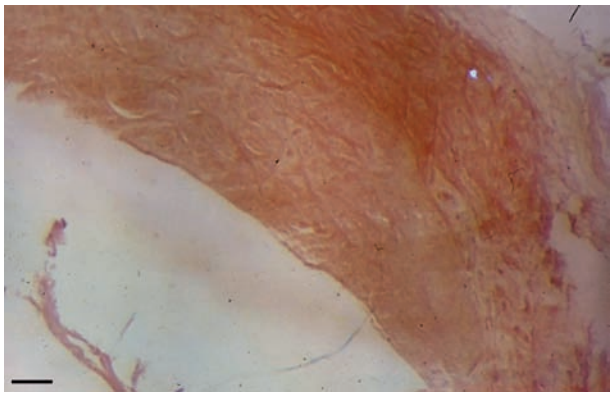

Figure 8. Human fetus - 32 weeks of gestation. Orcein. Bar = 200 μm

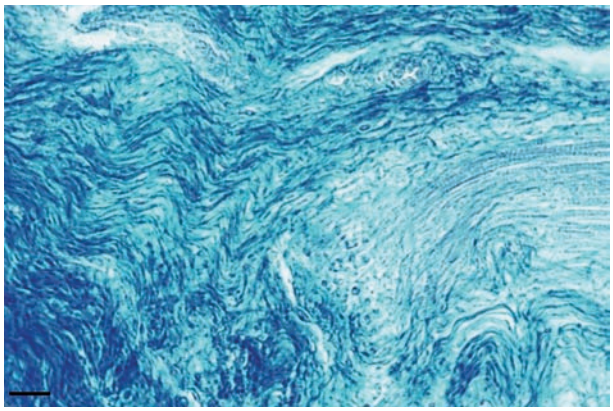

Figure 9. Human fetus - 18 weeks of gestation. Articular disc and condylar attachment Mallory Azan. Bar = 100 μm

in the form of thin irregular mesh, with prevalence of fibers in the longitudinal course. At the interface joint is observed a richer presence of fibrocytes. The central region of the disc is pots unpunished. On the edge, the disc appears covered by the synovial membrane (Fig. 9). As observed proves that the articular disc in two extremely different species which man and the rabbit, has a common character represented by the elastic component; which explain, the adaptability of this structure to the various mechanical stresses that the same is called, from time to time, to endure, albeit in a different anatomo-functional context.

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